FIRE TESTING PROCEDURES

AND

CONSTRUCTION DRAWINGS

FOR THE

BELT EVALUATION

LABORATORY TEST

DEVELOPED BY:

BUREAU OF MINES
PITTSBURGH RESEARCH CENTER

FOR:

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LABORATORY-SCALE FIRE TUNNEL TEST FOR CONVEYOR BELTING: TEST EQUIPMENT AND PROCEDURE

INTRODUCTION

In the development of this laboratory test, large-scale fire gallery experiments[1,2] were first conducted to study the flammability behavior of conveyor belting under simulated mine conditions. The laboratory-scale test conditions were then adjusted to result in similar belt fire damage to that obtained in the large-scale gallery[3]. The laboratory-scale test conditions that resulted were: sample size, 5-ft ± 1/4-in long by 9 ± 1/8-in wide by belt thickness (1/4-in to 3/4-in); distance of sample rack from test chamber roof, 8 ± 1/8-in; tunnel airflow, 200 ± 20 ft/min; burner ignition period, 5 ± 0.1 min; methane flow to burner, 1.2 ± 0.1 SCFM.

DESCRIPTION OF APPARATUS

The ventilated tunnel in which the belt tests are conducted is shown in Figure 1. The test chamber is 5-1/2-ft long by 18-in square and is constructed from 1-in thick refractory material. The square chamber is connected to a round exhaust duct via a 16 gage stainless steel plenum. The main exhaust is constructed from 1-ft diameter 18 gage galvanized steel ducting. An exhaust hood is mounted 2-in above the tunnel entrance and is connected to 8-in diameter ducting. Slotted angle iron was used to support the exhaust hood and accessory equipment. Blast gates (slide dampers) are used to regulate the airflow. The igniter is a commercially available 12 jet methane gas burner (2 rows of 6 jets). The belt sample is fastened to a steel rack constructed of slotted angle iron. A list of the major components and suggested sources[4] is given in the Appendix.

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[1] Lazzara, C. P. and Perzak, F. J. "Effect of Ventilation on Conveyor Belt Fires." Proceedings of Symposium on Safety in Coal Mining, Pretoria, South Africa, October, 1987, Paper 7.5, 15 pp.

[2] Verakis, H. C. and Dalzell, R. W. "Impact of Entry Air Velocity on the Fires Hazards of Conveyor Belts." Fourth International Mine Ventilation Congress, Brisbane, Australia, July 1988, pp. 375-381.

[3] Lazzara, C. P. and Perzak, F. J. "Conveyor Belt Flammability Tests: Comparison of Large-Scale Gallery and Laboratory-Scale Tunnel Results." Proceedings of the 23rd International Conference of Safety in Mines Research Institute, Washington, DC, Sept. 11-15, 1989, (to be published).

[4] References to specific products does not imply endorsement by the Bureau of Mines or Mine Safety and Health Administration.

CONSTRUCTION

Detailed drawings for construction of the test chamber, plenum, exhaust hood, debris tray, sample rack and burner support are given in Figures 2 and 3. The plenum section is constructed from 16 gage stainless steel, however, galvanized steel could be used. The inner surface of the plenum is lined with a 1/2-in thick ceramic fiber blanket which is attached with stainless steel screws to the plenum. The rack is constructed of shelving angle iron. The two longitudinal rails (5-in apart) are bolted together at three points with 5/16-in threaded rod. The rail supports (legs) are cut so that the distance from the rack mounting surface to the chamber roof is 8 ± 1/8-in. The supports are also bolted with threaded rod and braced. The belt sample is fastened to the rack by washers (1/16-in sheet metal cut into 3/4-in squares with a 3/16-in hole) and cotter pins (1/8-in diameter x 2-in).

The burner fuel is compressed methane (technical grade, 98%) which is regulated and then controlled with a needle valve prior to entering a rotameter. The methane flow is adjusted to 1.2 ± 0.1 SCFM of methane (0.95 SCFM air equivalent at 72° F). The burner is a 12 jet assembly shown in Figure 3. The burner is centered in front of the belt sample's leading edge and can be moved up or down, left or right, on the cross bar by loosening the set screws on the crossover piece. The burner jets should be approximately 1/2-in in front of the sample.

PROCEDURE

1. SAMPLE PREPARATION AND MOUNTING

Three samples of the candidate belt are cut longitudinally into the required sample size and stored flat in the laboratory for at least 24 hours prior to the test. The belt sample is placed on the rack such that 1 ± 1/8-in of the belt extends past the front edge of the rack and 1 ± 1/8-in extends evenly over each side rail. Five pin and washer sets on each side of the of the belt are usually sufficient for securing the belt. The first belt hole is drilled at the first rack hole behind the leading edge of the belt, the second hole is 6-in from the first, and the third, 6 to 8-in from the second; the last two holes can be at any place along the belt. The first three belt hole positions are close together to prevent the end of the belt in the ignition area from curling or pulling away from the burner flame. After the belt is mounted, it is placed in the test chamber with the front end of the belt 6-in from the entrance. The top surface of the belt, depending on its thickness, will be approximately 7-3/4-in to 7-1/4-in from the roof.

2. TUNNEL AIRFLOW

The airflow is set to 200 ± 20 ft/min as measured with a nominal 4-in diameter vane anemometer placed on the belt 1 ft from the chamber entrance. The flow is adjusted by a blast gate in the tunnel exhaust.

APPENDIX : List of Major Components

ITEM	PART NO.	APPROXIMATE PRICE	SUGGESTED SOURCE
TEST CHAMBER Marinite I, 2 sheets, 4' x 8' x 1"		$194.60 SHT	TAYLORED INDUSTRIES INC P.O. Box 9552 Pittsburgh, PA 15223 (412) 781-7656
MISCELLANEOUS Attachment screws for Fiberfrax, stainless steel Type 302 screw 8-32 x 1" lockwasher size 8, washer flat size 8, capnut 8-32 machine screw nut flat washer size 5/16" Attachment cotter pins for belt 1/8" x 2"		Nominal	WILLIAMS & COMPANY 901 Penn Avenue Pittsburgh, PA 15233 (412) 737-2211
SLOTTED ANGLE SUPPORT 14 gage, 2 1/4" x 1 1/2" x 10' 18 lengths per bundle Not shown in the drawings	6510	$107.63 BN	FRICK & LINDSAY COMPANY 3499 Grande Avenue Neville Island Pittsburgh, PA 15225
BENCH 10' steel 120" L x 29" W x 33" H		212.00 EA	CUSTOM WELDING INCORPORATED 606 Delco Drive Clinton, WI 53525 (608) 676-5516
DEBRIS TRAY			In-house fabrication

ITEM	PART NO.	APPROXIMATE PRICE	SUGGESTED SOURCE
BURNER			
U-10 burner w/no. 640 Jets (12)		$48.07 EA	SOLARFLOW CORPORATION 22901 Aurora Road
Extra Jet Tips		$1.68 EA	Bedford Hts, OH 44146 (216) 439-1680
Flowmeter: 1 SCFM airflow 10" Glass Flowmeter 1/2" NPT fittings Not shown in the drawings	5210 G1110 XXAA 2025X	$419.00 EA	WALLACE AND TIERNAN Penwalt Corp. 25 Main Street Belleville, NJ 07109
Burner support pipe fittings, 3/4" cross over 3/4" rail hanger, 3/4" collar stop	73-112/5A 73-156/2A 73-162/8A	$3.58 EA $5.35 EA $2.37 EA	C&H DISTRIBUTORS P.O. Box 04499 Milwaukee, WI 53204
RACK			
Perforated Vertical Shelving Angle Iron, 1" x 1 3/4" x 1/8" all-thread rod, 5/16"		$11.45 EA per 10 ft	BETHEL PARK STORAGE & HANDLING Pittsburgh, PA 15236 (412) 835-5188
EXHAUST			
Front Hood (steel)			In-house fabrication
Plenum (square to round transition) 16 gage 304 stainless steel	custom fabrication	$438.00 EA	ACME ROOFING & HEATING CO 1600 Noblestown Road Pittsburgh, PA 15205 (412) 921-8218
Fiberfrax Durablanket 8 lb/cu ft Density, 1/2" x 2' wide.		$150.00 100 sq ft	CHIZ BROS INC RD #4 Box 40A Elizabeth, PA 15037 (412) 384-5220
Tunnel exhaust Spiral duct, 18 gage Standard Round, 1' and 8" diameter			DECKMAN COMPANY P.O. Box 16188 700 Idlewood Avenue Carnegie, PA 15106 (412) 429-8667

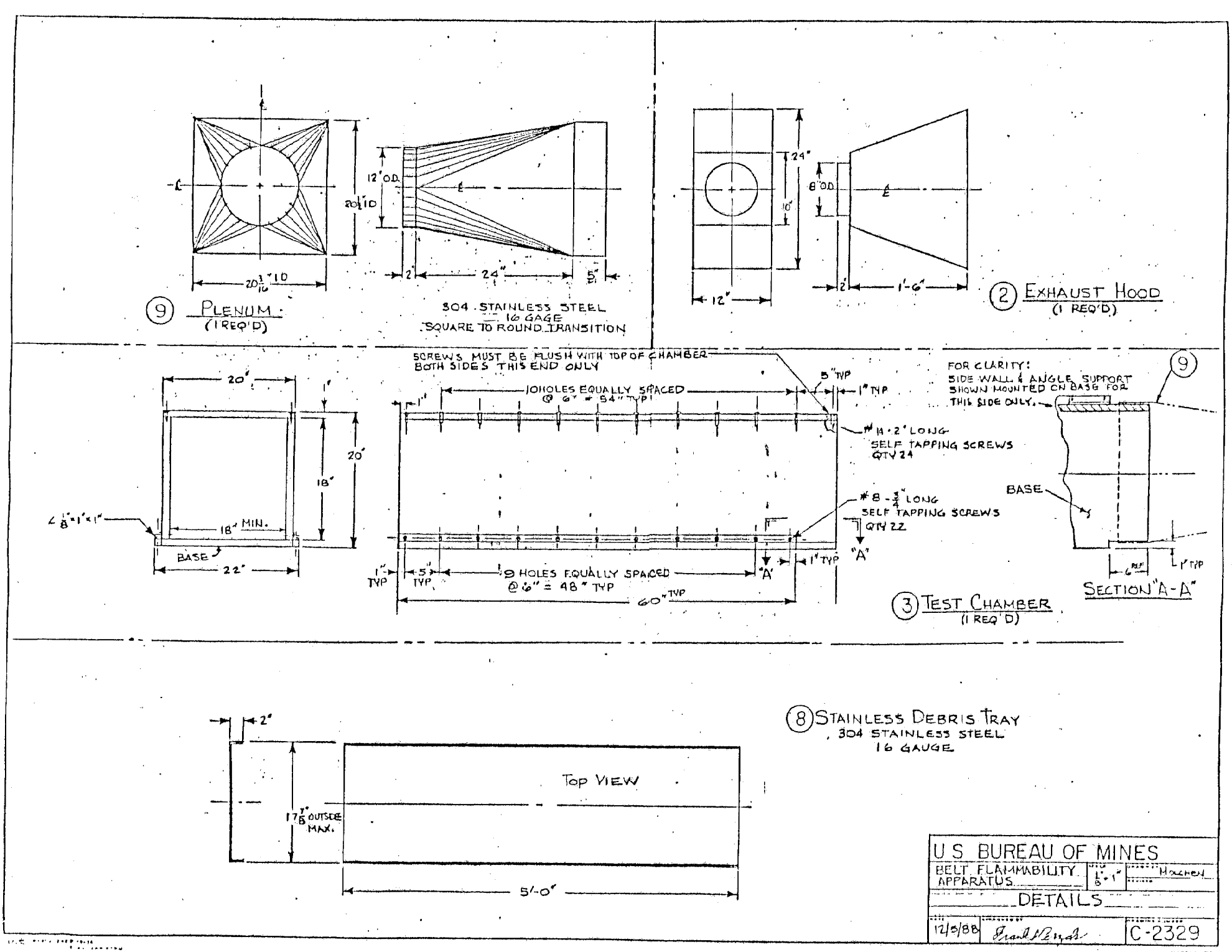

Figure 2. -Exhaust, test chamber, and debris tray details.

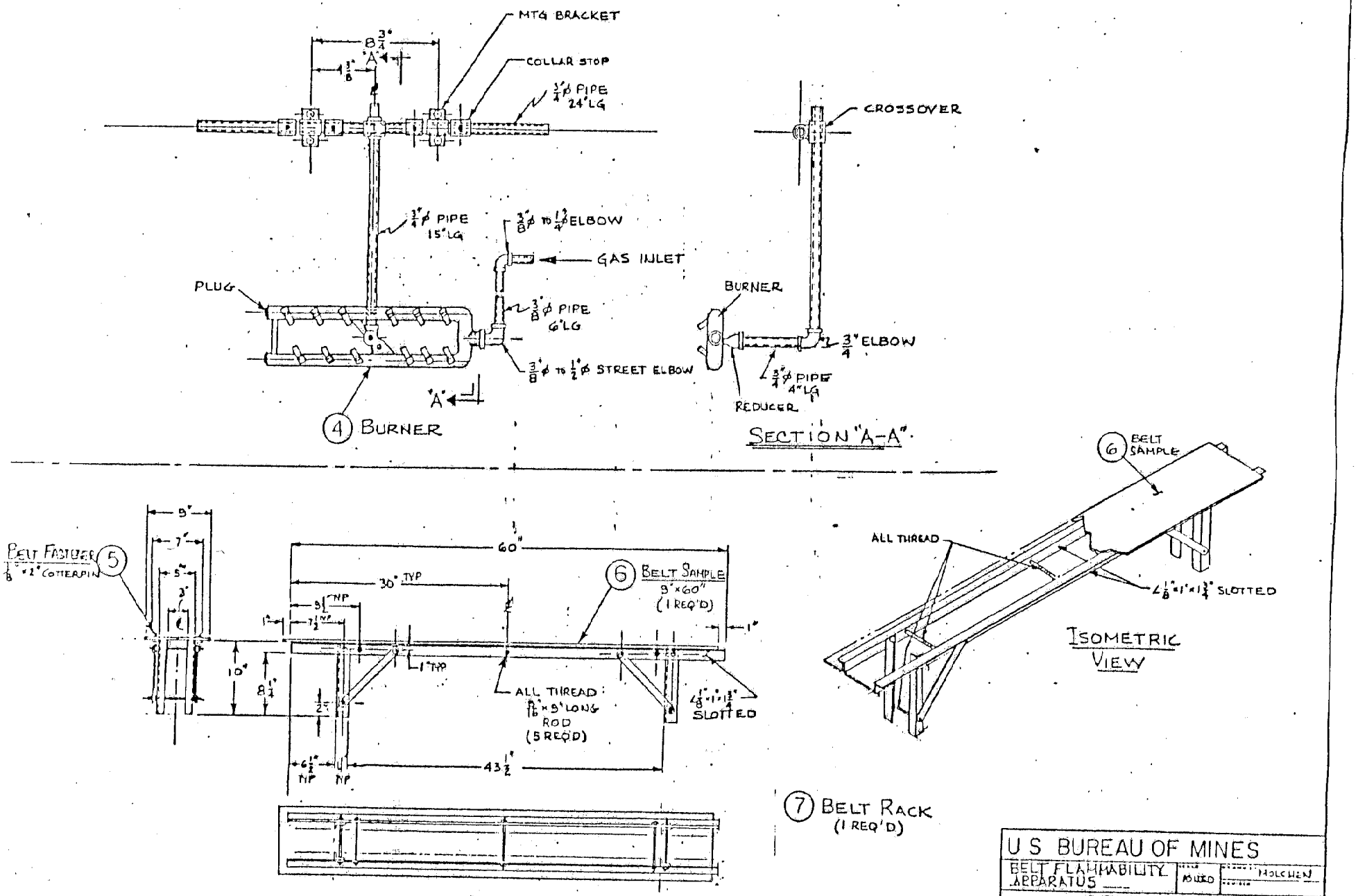

Figure 3. -Burner and sample rack details.